# COMBINED ARMS COLLECTIVE TRAINING FACILITY (CACTF) DOWNRANGE POWER & DATA DISTRIBUTION

Function: The section explains the unique design requirements for the Combined Arms Collective Training Facility (CACTF) downrange power and data distribution to control Next Generation Army Target System (NGATS) range targetry and its associated equipment. Refer to the range Narrative to clarify applicability of this section to a specific range type.

General Summary: Power shall be distributed throughout the facilities via primary power cables connected to step-down transformers, sectionalizers, or switches and routed to power panels located in the electrical/communications rooms. The number of electrical/communications rooms is determined by the quantity of buildings and their proximity to each other. Communication cabling shall be distributed from the Range Operations Center (ROC) via fiber optical cabling to the zoned electrical/communication rooms central hubs. The quantity of buildings and their proximity to each other shall also determine if fiber optical or Category 6 copper network cables shall be used from the central hub electrical/communication rooms to the connecting buildings for data distribution. From the electrical/communications room the power and data shall be distributed to the buildings' target power and data outlets, cameras, lighting, and other systems as required. A network connection from the CACTF to the Installation backbone is not a requirement.

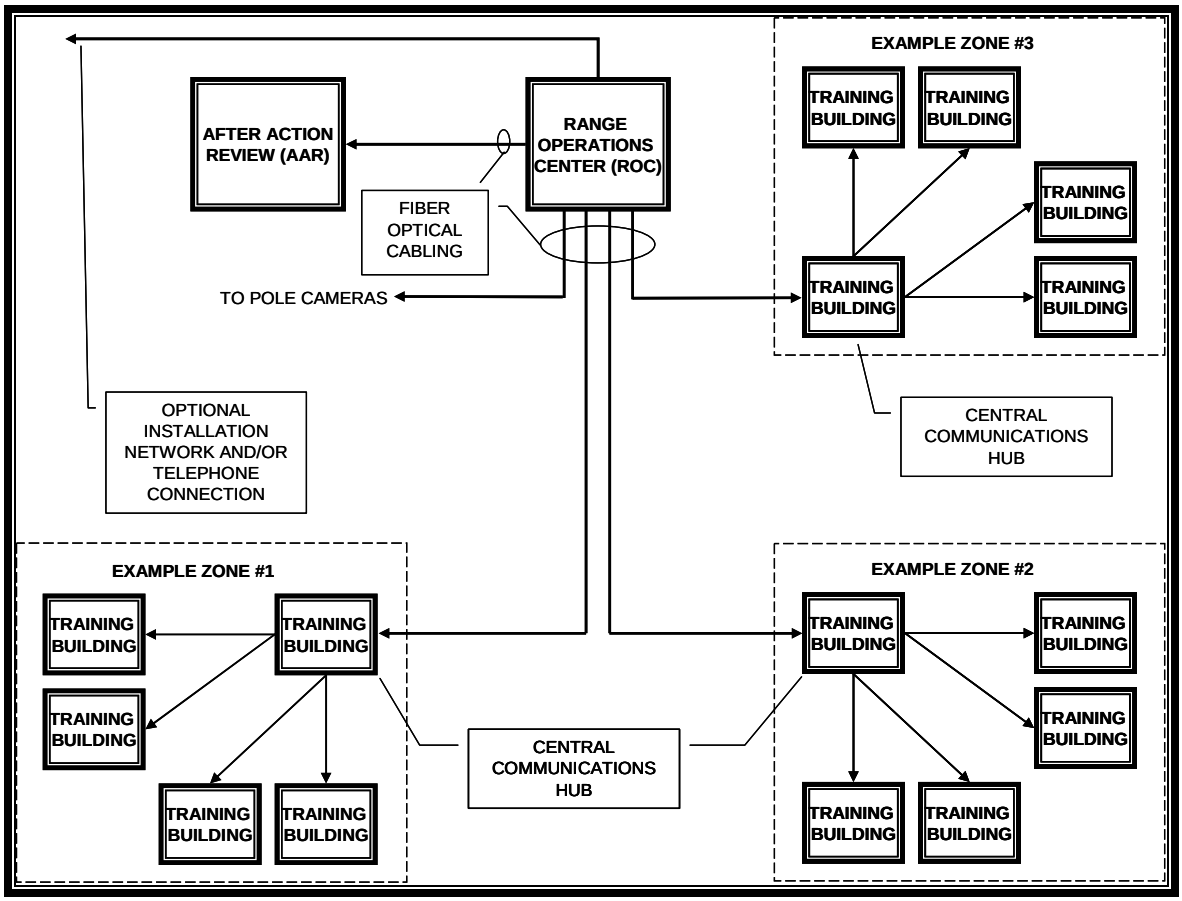
Site Power Distribution: Primary power (12.47kV) is run underground from the dead-end riser pole at the boundary of the range site to a pad-mounted transformer located inside the Range Operations and Control Area (ROCA) near the ROC. Single-phase power (120/240V) shall be fed underground from the pad-mounted transformer to the After Action and Review Building AAR power panel and the ROC power panel. The other facilities in the ROCA shall be fed underground from the AAR power panel and the ROC power panel. Underground three phase primary power shall continue from the dead-end riser pole near the flagpole and run to the range site. If the distance between the ROCA and the range site is lengthy; overhead power line may need to be considered due to funding. If overhead power is used, care must be taken to ensure that lines are not exposed to vehicular traffic either near roadways or maneuver lanes. A mock overhead primary power line shall run within the CACTF to each range training facility. The actual primary power shall run underground from the range dead-end riser pole to pad-mounted switches and transformers. The range training facilities shall be supplied with 120/240V power from the nearest pad-mounted transformer or nearest available 120/240V power panel. The power transformers shall be of the low-profile design to reduce the impact on training. The power transformers should also be located in a remote area as much as possible to reduce chance of transformer damage and impeding training. Targets at each range training building shall be fed from the nearest power panel. Voltage available to each target shall be no less than 95 percent of the target's rated operating voltage. The secondary power cable is not required to follow the direct burial

cabling requirements as stated in the general downrange section of this manual. A ductbank system is the preferred method for power and data cable distribution.

Training Building Power: Targets at each range training building shall be fed from the nearest power panel in the electrical/communications room. All electrical room power panels shall be installed as far as possible from the communication rack to help minimize electrical interference. Electrical rooms shall require one quadruplex power outlet with two independent power circuits per communication rack to supply electronic equipment. All communication racks, power panels, cable trays, and wireways shall be bonded to ground. Voltage available to each target shall be no less than 95 percent of the target's rated operating voltage. When lighting control switches are provided in the training building area they shall be recess mounted in the wall. Maintenance outlets shall be provided in all training buildings in the optimum location as to allow for a 25 foot power cord to reach all training room areas as needed for maintenance purposes. All conduits, electrical devices, and target outlets shall not be installed on the interior walls below 2134mm (7 ft) A.F.F. (*exception: recessed lighting control switches and raceways located in rooms, hallways, or stairwell corners*). If raceways or conduits are necessary between floors for the data or power they should be located in the corner of a room, hallway, or stairwell and mounted tight against the wall to prevent damage by training activity.

The minimum size for an electrical/communication room should be sized to allow 914mm (3 ft) of access clearance to the front, rear, and one side of the communications rack or racks and to maintain the National Electrical Code (NEC) requirements for the power panel.

Site Data Distribution: Downrange fiber optic data distribution cables shall be installed underground from the ROC to each range training building that is designated as a central communications hub (See Representative Downrange Distribution). The cables shall be single or multi-mode fiber optic dependant on distances between facilities. If the total fiber optic cable link exceeds 1500m, Single Mode (SM) type will be used, at 1500m and under it will be multi Mode (MM) type. The total number of "patches" or pass through terminations shall not exceed a total of three. At the electrical/communications room communication rack the fiber optic cable shall be converted to Category 6 Shielded Twisted Pair (STP) cables or better and distributed to targets and other optional instrumentation components. Targets are controlled via an Ethernet based protocol network which means each individual Target Data Outlet (TDO) connector shall have a dedicated network cable routed back to the communications rack and terminated. The network cable shall not exceed 90m in total length under any condition.




Representative Downrange Data Distribution (Not to Scale)

Training Building Data: Approximate fiber optical cable quantities for a training building are based on the following table:

| **Component** | **Quantity** |
|---|---|
| Interior & Exterior Video Cameras | One strand per every four interior camera enclosures |
| Exterior Video Cameras (Pole Mount) | Dedicated six strands per each |
| Audio | One strand per building |
| Targetry | Two strands per building |
| Spare | 30% for future use |

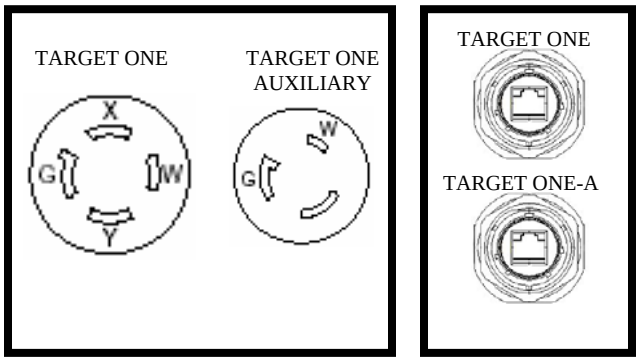
Fiber Strand Quantity Estimate Chart

From the electrical/communications room communication rack the fiber optic cable may be distributed to other building communication rooms when necessary. The fiber optic cable shall be terminated with "SC" type connectors at each electrical room in a standard communication rack patch panel. The minimum size for an electrical/communication room should be sized to allow 914mm (3 ft) of access clearance to the front, rear, and one side of the communications rack or racks with a minimum of 6 inches on the remaining side. Multiple racks will be "ganged" or joined together. The communication rack may be a standard stand-alone or wall-mount depending on the number of instrumentation components (targets, cameras, speakers, etc.) in the associated building. If wall mount communication enclosures are used only a 914mm (3 ft) clearance in front of enclosure is required. Each individual TDO RJ45 connector shall receive an individual network cable from the electrical communication rack supplied by Military Construction Defense (MILCON) and terminated with a Category 6 or better, NEMA4X, female RJ45 connector as approved by the Range Configuration Control Board (RCCB). The TDO shall have minimum of 305mm (12in) of network cable slack. All target outlets should have weatherproof covers as well as being weatherproof while target is connected. Network cable shall not exceed 90m in total length. The target control, video, and audio cabling shall be installed in a 152mm x 152mm (6 in x 6 in) wireway system and conduits from the electrical/communications room to the devices. The wireway system should be installed as close to the ceiling as possible to allow adequate space for mounting of target outlets, cameras, and speaker systems if required. If the wireway installation can not maintain a continuous pathway through the building due to routing around bond beams or other obstructions, conduit or whatever means used to connect the raceways must be equal to the cross-sectional area of the wireway being connected. All wireways installed in the training areas should be covered and unused holes sealed to prevent damage to cabling by rodents and other infestations. All conduits, electrical devices, and target outlets shall not be installed on the interior walls below 2134mm (7 ft) A.F.F. (*exception: recessed lighting control switches and raceways located in rooms, hallways, or stairwell corners*). When raceways or conduits are necessary between floors for the data or power they should be located in the corner of a room, hallway, or stairwell and mounted flush against the wall to prevent damage by troop activity.

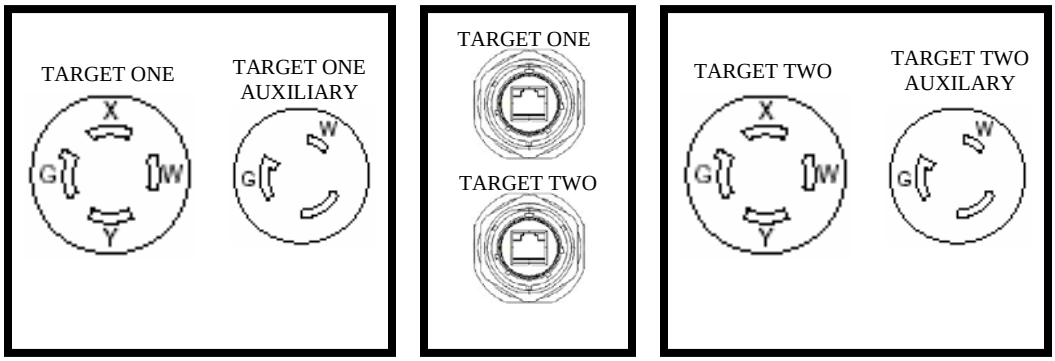
Electrical/communication rooms requiring a full size communication rack shall have a ladder type cable tray system encircling the perimeter of the room. Ladder type cable tray size and quantity should be according to the number of targets, speakers, cameras, and control circuits in the associated training building that shall be routed to the communication rack. Electrical/Communication room ceilings and walls shall be sealed from moisture and dust.

Target Data Outlets: All target outlets shall be mounted at a minimum 2134mm (7 ft) A.F.F. to the bottom of the outlet box. Conduits shall not be installed on the interior walls below 2134mm (7 ft) A.F.F. Target outlets can be either single or double in their configuration with single being the standard (See Representative Target Outlet Drawings in this document). Target power and data outlets shall be weatherproof when in use and when they are not in use.

Stationary Infantry Target (SIT) and Stationary Armor Target (SAT) emplacement information is found elsewhere in this manual.




Representative Single Target Outlet (Not to Scale)




Representative Double Target Outlet (Not to Scale)

| TARGET POWER RECEPTACLE | AUXILIARY POWER RECEPTACLE | FIBER OPTIC CABLE CONNECTORS | CATEGORY 6 CABLE CONNECTORS |
|---|---|---|---|
| NEMA L14-20R | NEMA L5-20R | Type “SC” | FEMALE, RJ45 |

Target Data Outlet Interface Specifics

| EMPLACEMENT TYPE | POWER FEED TYPE | PEAK | STATIC LOAD | DESIGN LOAD |
|---|---|---|---|---|
| SIT and Single Target Outlet with Thermal Blanket | 120/240V, Single Phase | 700VA while raising or lowering target. Add 260VA if Thermal Blanket is utilized. | 50VA Thermal Blanket 260VA | 960VA |
| | | | **Total** | **960VA** |

Single Target Outlet Power Table